Transdisciplinarity Among Tobacco Harm Reduction Researchers: A Network Analytic Approach

Keith G. Provan, Ph.D.
University of Arizona

Pamela I. Clark, Ph.D.
Battelle Centers for Public Health

Timothy R. Huerta, Ph.D.
Child and Family Research Inst., B.C.

The Research Questions

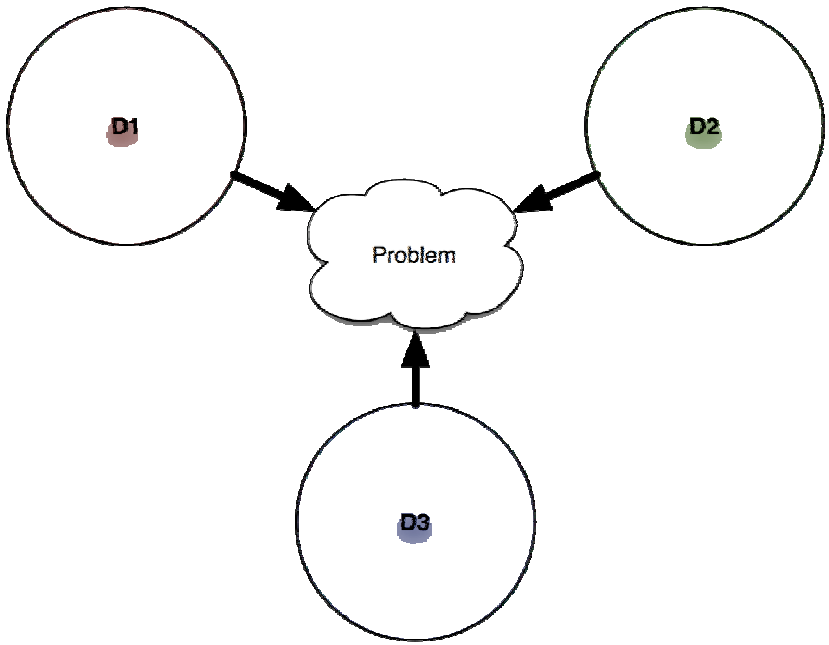
- What does the tobacco harm reduction research network look like? (i.e., Who is involved and in what ways do they interact?)
- Do THR researchers collaborate across, or only within academic disciplines and what is the structure of such cross-disciplinary networks?
- Is the HR network achieving transdisciplinarity and what is the structure of that network?
- Do THR researchers collaborate across areas of expertise, and in what ways?

The Harm Reduction Research Network

- 68 people identified within the network
  - Using the Crisp Database
    - researchers receiving funding
  - PubMed searches
  - Reputational sampling for final selection using an “expert” panel
- 67 completed network membership applications
  - 98.5% response rate
  - No returned applications were disqualified

Defining types of *Cross-Disciplinary Research*

- Multidisciplinary
  - Researchers in different disciplines work independently, each from within their own disciplinary specific perspective, to address a common problem

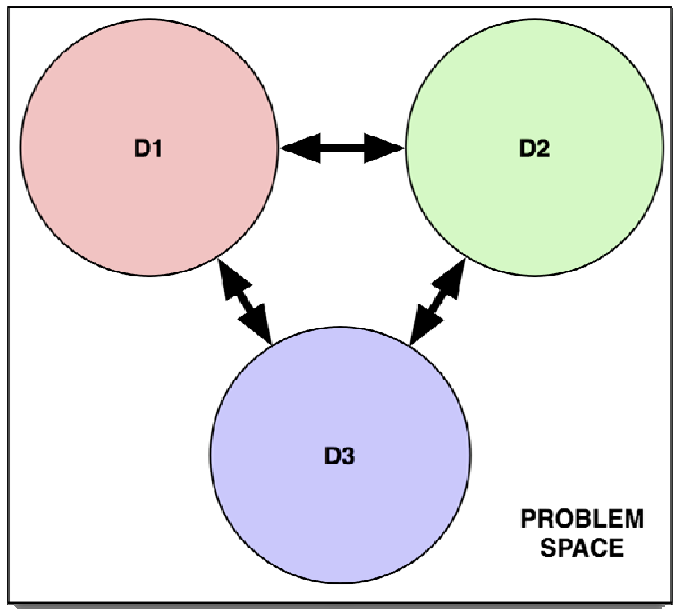


D1, D2 and D3 represent different disciplinary areas
Multidisciplinary approaches occur when a problem is being studied from more than one discipline

Rosenfield, P.L. (1992). The potential of transdisciplinary research for sustaining and extending linkages between the health and social sciences. Soc Sci Med, 35, 1343-57.

Defining types of *Cross-Disciplinary Research*

- Interdisciplinary
  - Researchers in different disciplines work jointly, but each from within their own disciplinary specific perspective, to address a common problem

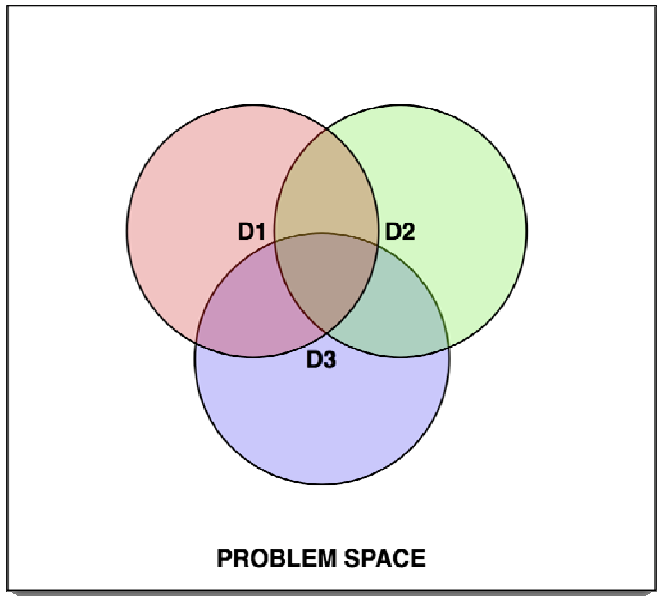


D1, D2 and D3 represent different disciplinary areas
Interdisciplinary approaches occur during
exchange of one or more disciplines where
there is no integration of frameworks or perspectives

Rosenfield, P.L. (1992). The potential of transdisciplinary research for sustaining and extending linkages between the health and social sciences. Soc Sci Med, 35, 1343-57.

Defining types of *Cross-Disciplinary Research*

- Transdisciplinarity
  - Researchers in different disciplines work jointly, using a shared conceptual framework that draws together disciplines, to address a common problem in ways that go beyond what could have developed within a single discipline (i.e. synergy)



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Identifying Researcher *Disciplines*

- Free-form answers
- Asked the area of highest degree earned
- 8 categories were created based on groupings that seemed reasonable

Disciplines of Tobacco Harm Reduction Network Members

Disciplines	Fields included	Frequency
Chemistry/ Toxicology	Physical Chemistry; Organic Chemistry; Bio-Organic Chemistry; Geo-Organic Chemistry; Toxicology; Biochemistry	12
Epidemiology	Epidemiology	4
Medicine/Nursing/ Dentistry	Medicine; Nursing; Dentistry	8
Other Behavioral	Behavioral Sciences; Health Education; Philosophy; Communication Research; English, Public Health; Education	8
Other Bench	Biophysics; Physiology	2
Pharmacology	Pharmacology; Psychopharmacology	4
Policy/Law/Ethics	Health Policy; Social Policy; Law	4
Psychology/ Psychiatry	Psychology; Clinical Psychology; Experimental Psychology; Health Psychology; Physiological Psychology; Social Psychology;	25

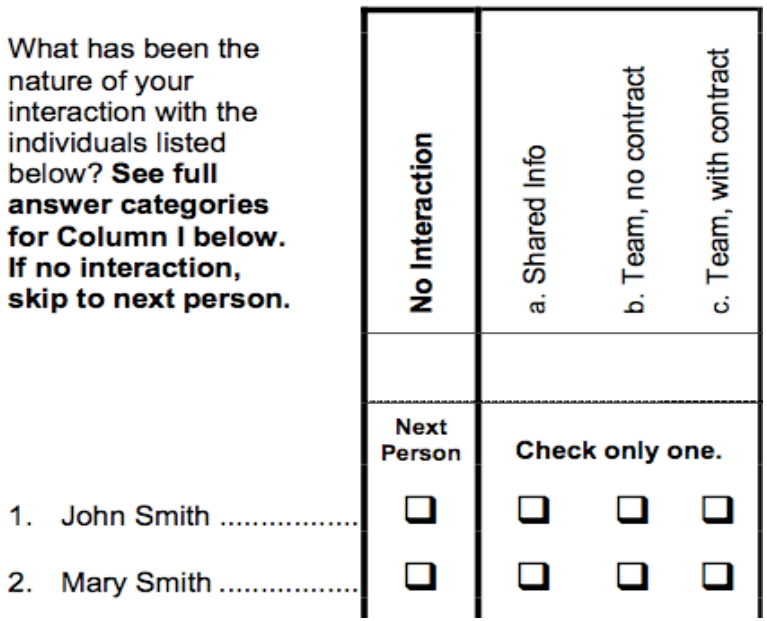
Expertise

- 17 “expertise” domains were identified through consultation THR researchers.
- Expertise based on respondent self-reports as “none/limited,” “some,” or “strong.”

Frequencies and Proportions of THRN Members Reporting “Strong Expertise” in 17 Tobacco Harm Reduction Content Areas

Area of Expertise	Frequency	Percent
Preclinical	13	19.4
Smoke Chemistry	16	23.9
Smoking Topography	20	29.9
Physiology	11	16.4
Addiction	35	52.2
Genetics	9	13.4
Clinical Trials	12	17.9
Cessation	33	49.3
Adolescent Smoking	21	31.3
Biomarkers	14	20.9
Advertising and Promotions	9	13.4
Program Evaluation	11	16.4
Tobacco Industry	12	17.9
Population Surveillance	14	20.9
Economics	4	6
Tobacco Control Law	16	23.9
Ethics	9	13.4

Measuring Collaboration



What has been the nature of your interaction with the individuals listed below? **See full answer categories for Column I below. If no interaction, skip to next person.**

	No Interaction	a. Shared Info	b. Team, no contract	c. Team, with contract
	Next Person	Check only one.		
1. John Smith	❑	❑	❑	❑
2. Mary Smith	❑	❑	❑	❑

- "What has been the nature of your interaction with the individuals listed below"
- Four Categories
  - No Relationship (0)
  - Shared Information (1)
  - Team Relationship, no contract (2)
  - Team Relationship, with contract (3)

Defining Level of Collaboration

- No Relationship (67.44%)
- Shared Information (22.61%)
  - Got specific information from or provided information to this individual via any direct process (e.g., email, telephone, personal discussion, etc.). Please do not include joint participation on an electronic list serve.
- Team Relationship, no contract (6.11%)
  - Worked together as part of a team but without a formal arrangement (i.e. without a contract, joint funding, etc.)
- Team Relationship, with contract (3.84%)
  - Worked together as part of a formal team with a contract, memorandum of agreement, joint funding or formalized sharing of resources.

Coding the Network Data as Confirmed Ties: An Example

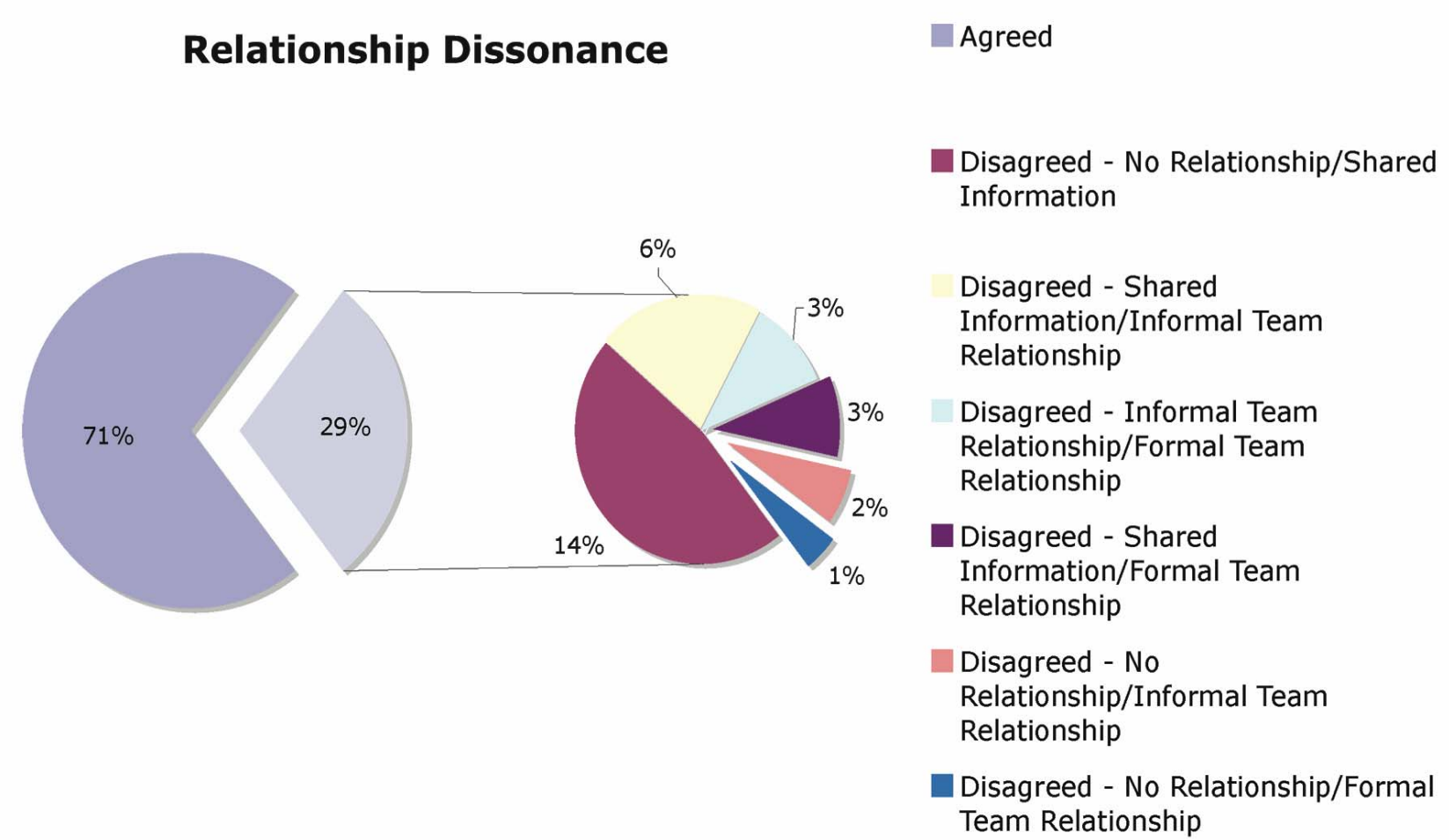
	Tim	Brian	Seth	Mary
Tim	0	1	2	2
Brian	3	0	3	3
Seth	2	1	0	2
Mary	0	1	0	0

Total agreement = 71%

	Tim	Brian	Seth	Mary
Tim	0	1	2	0
Brian	1	0	1	1
Seth	2	1	0	0
Mary	0	1	0	0

Conflict in agreement = 29%

Disagreement between Respondents Regarding Type of Relationship



Items for Indices of Multidisciplinary, Interdisciplinary and Transdisciplinary Relationships Among THRN Members

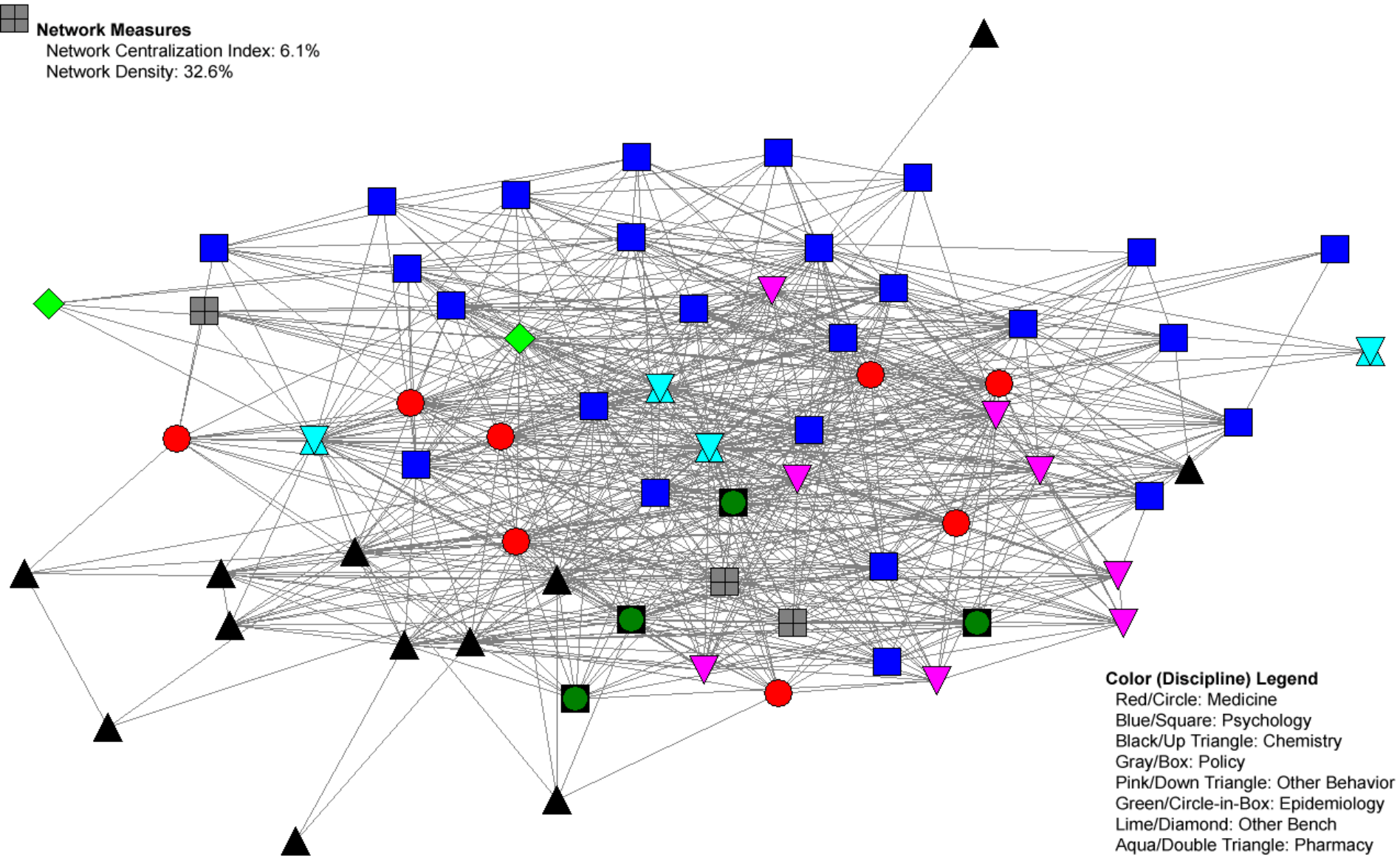
Item	Multidisciplinary Relationship	Interdisciplinary Relationship	Transdisciplinary Relationship (Synergy)
a. No interaction	Yes		
b. Interaction but no outcome (Shared information, worked on team, etc.)		Yes	
c. Resulted in a product			Yes
d. Product contained elements beyond what you could have developed on own			Yes

r = .94 (c with d); r = .60 (b with d)

Comparative Statistics for Two Levels of Network Interaction – No Outcome & Synergy

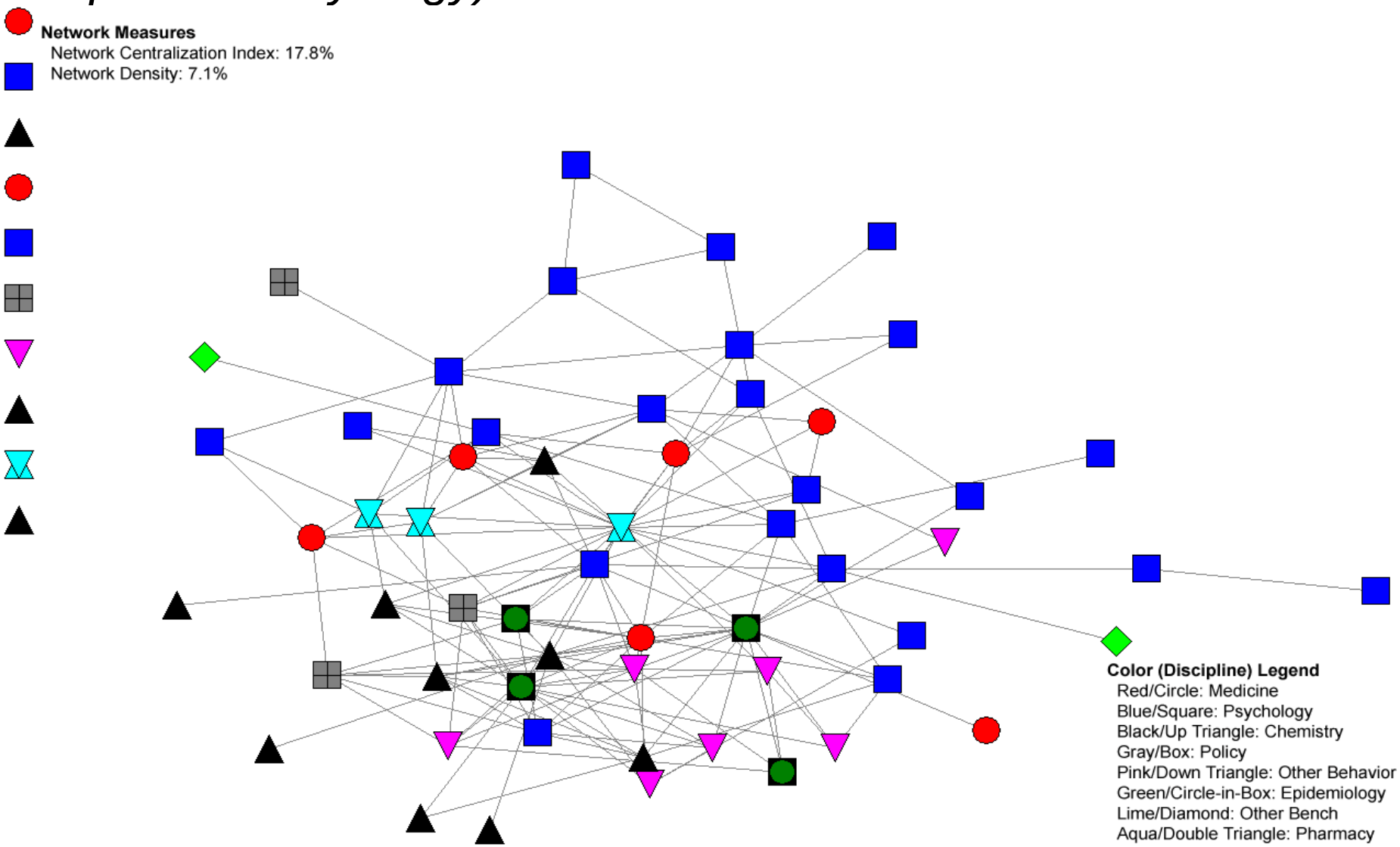
Network Measure	No Outcome	Synergy	Concept Definition
Network Density	32.56	7.1	Total actual number of connections as a percentage of total possible connections
Maximum Degree	78.79	30.3	Greatest number of connections (normalized)
Minimum Degree	0	0	Fewest number of connections (normalized)
Network Betweenness	1.1	1.8	Extent to which network actors mediate, or fall between, any other two actors on the shortest path between those actors.
Maximum Betweenness	7.11	19.334	Highest betweenness centrality
Minimum Betweenness	0	0	Lowest betweenness centrality
Fragmentation	0.363	0.679	Proportion of pairs of nodes that are unreachable from each other
Inclusiveness (N=66)	98%	85%	The percentage of actors connected to others
Network Centralization Index	6.11	17.8	The extent to which a network is centralized around one or a few actors

Overview of the HR Interdisciplinary Research Network by Discipline (any type of link – no outcome)



The Transdisciplinary HR Research Network

(Outcomes that have shaped thinking & resulted in a product – synergy)



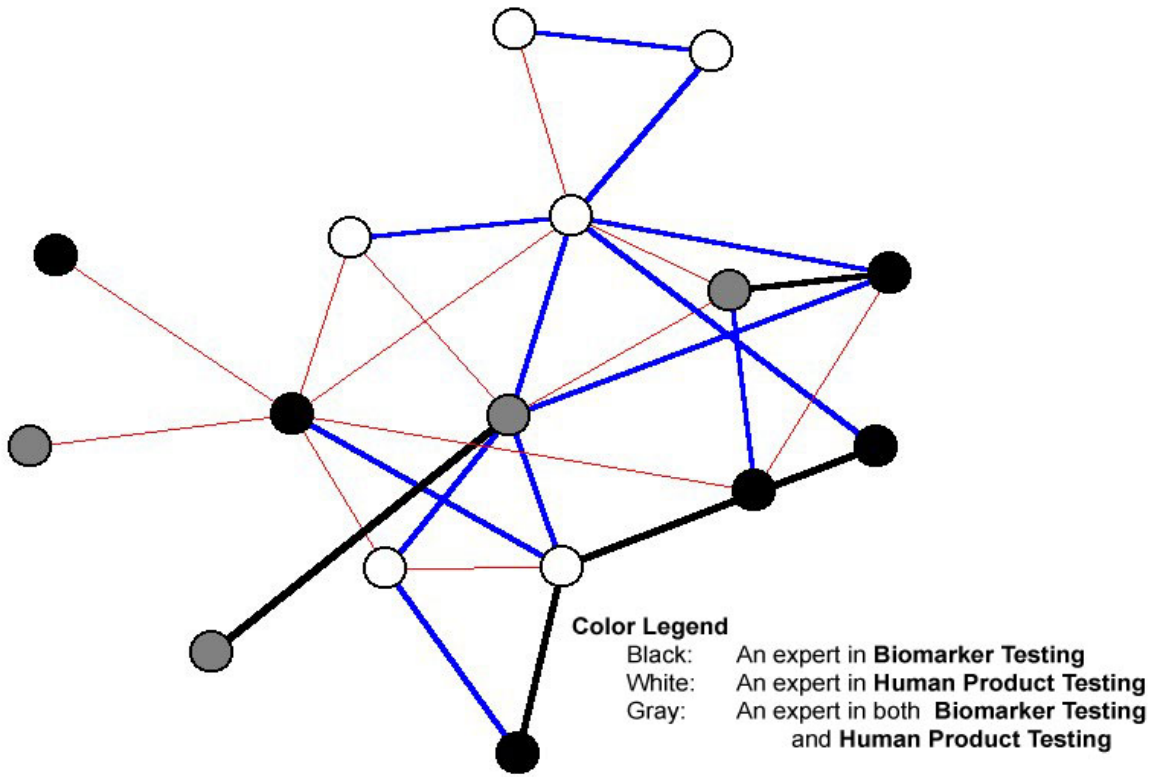
Comparison of Homophily versus Heterophily: Network Ties Across Disciplines

Discipline	No Outcome Links		Synergistic Links	
	Average ties to researchers in same discipline (Homophily)	Average ties to researchers in other disciplines (Heterophily)	Average ties to researchers in same discipline (Homophily)	Average ties to researchers in other disciplines (Heterophily)
Medicine n=8	2.13	11.2	0.00	2.19
Psychology n=25	5.00	5.72	0.84	1.16
Chemistry n=12	2.17	4.71	0.50	1.46
Policy n=4	0.25	7.38	0.00	2.00
Other Behavior (8)	1.88	10.3	0.63	1.69
Epidemiology n=4	1.25	12.6	0.50	5.00
Other Bench n=2	0.50	8.5	0.00	0.50
Pharmacology n=4	1.00	14.12	0.25	3.88
Indiv. Average	**2.90**	**7.85**	**0.34**	**1.82**

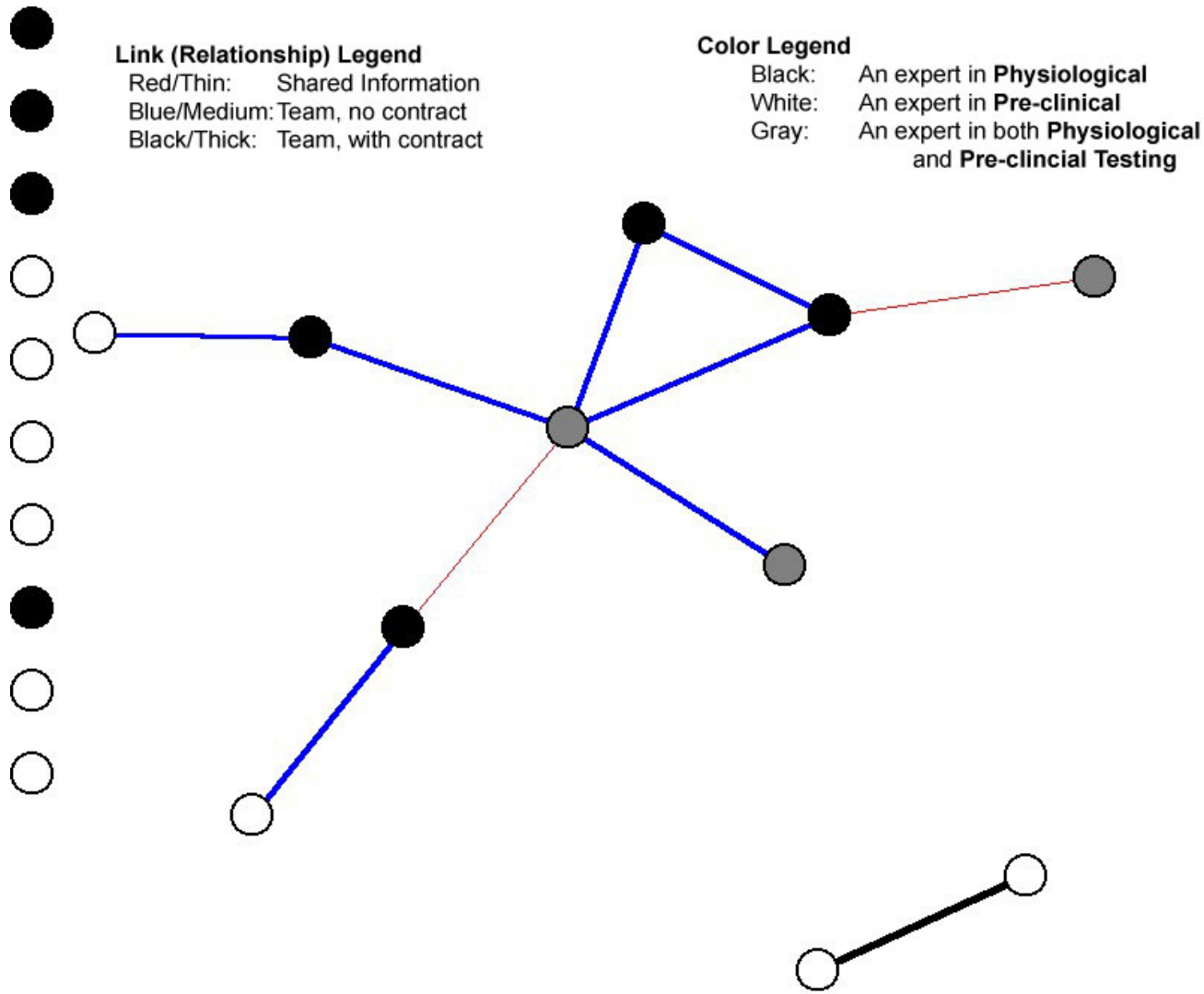
Expertise: An Alternative Method for Mapping THR Networks

- Network plots developed showing connections among researchers based on area of expertise (“strong expertise” from Q2)
- We examined subnetworks based on interactions across pairs of expertise (i.e., pre-clinical with addiction) – 136 possible pairings ((17x16)/2)
- 3 different types of connections reported: shared info., formal no contract, and contract
- Subnetworks grouped into broad categories of types of interaction – see examples

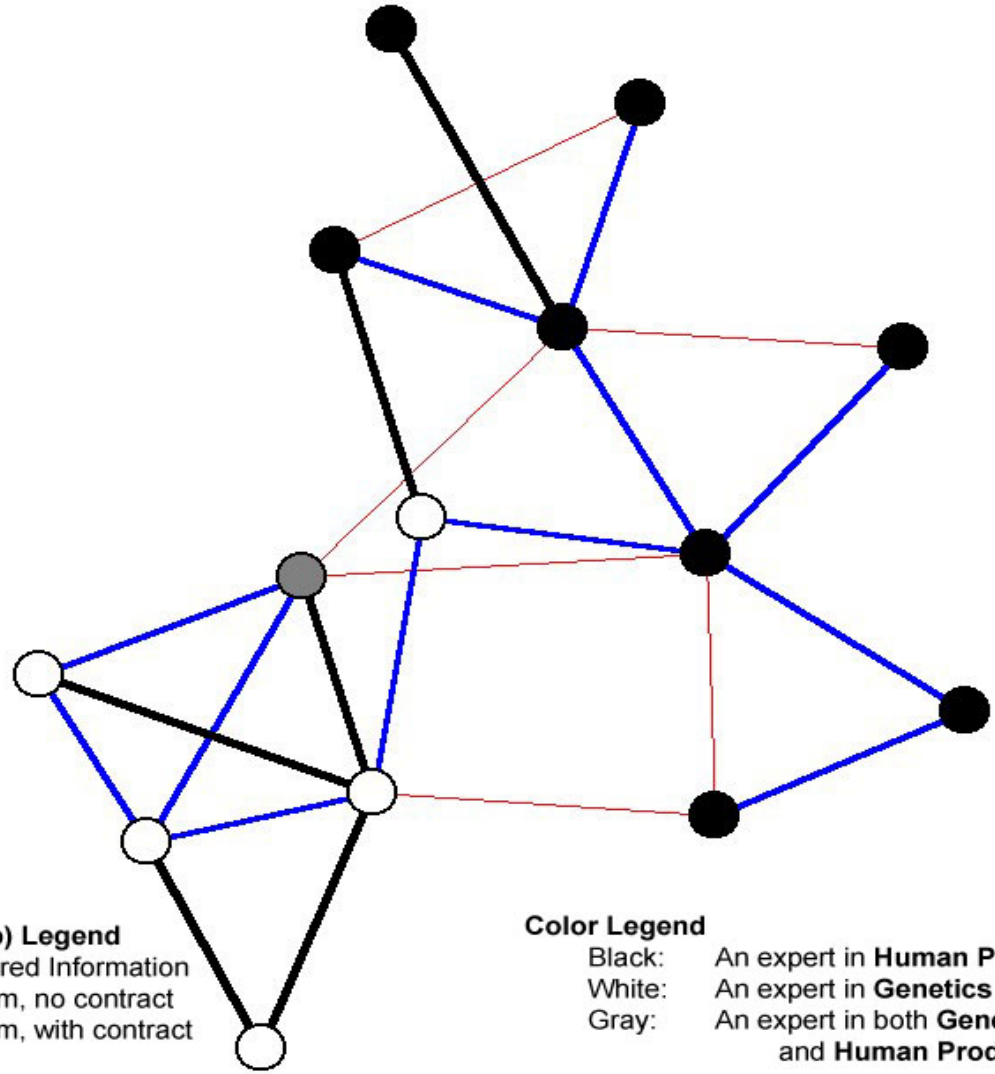
Dense Cross-Domain Network



Disaggregated Network



Brokered Network



Link (Relationship) Legend

Red/Thin: Shared Information
Blue/Medium: Team, no contract
Black/Thick: Team, with contract

Color Legend

Black: An expert in **Human Product Testing**
White: An expert in **Genetics of Addiction**
Gray: An expert in both **Genetics of Addiction** and **Human Product Testing**

Conclusions

- Presented a new methodology, based on social network approaches, to understanding collaborative interactions among THR researchers
- Provides baseline data to use in evaluating network capacity-building efforts (but requires an “informed perspective” to determine where increased connections between disciplines should be built)
- First step toward quantifying the structure and impact of transdisciplinary networks
- Future steps will link specific outcomes with network involvement and examine evolution of ties